SCM100 dc/dc LVDT DRIVER

The LVDT Signal Conditioning Module SCM100 has been specifically designed to operate with the AF111 and AF145 range of LVDT's, and to make using an LVDT as simple as using a linear potentiometer.
This module incorporates a high performance circuit which drives the LVDT in a ratiometric configuration, thereby maximising system accuracy by eliminating effects caused by temperature and supply current variations.

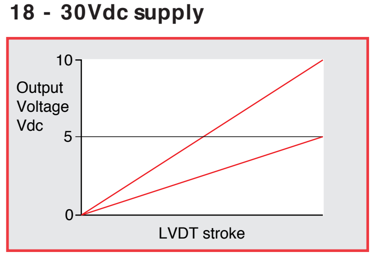
PERFORMANCE

Supply voltage	**Vdc**	18 - 30 (regulated) or ± 15 (regulated)
Supply current	**mA**	100 maximum
LVDT excitation voltage	**Vrms**	3 (nominal)
LVDT excitation frequency	**Hz**	2.5k (nominal)
Output voltage* (SCM100/V)		See output options on page 9 for full details
Output current (SCM100/I)		See output options on page 9 for full details
Output ripple	**mVrms**	< 5
Output load	**Ω**	1k minimum (resistive) - voltage and current output
Frequency response	**Hz**	300 (-3dB)
Non-linearity		± 0.05% max (over 1% to 99% of stroke when used with AF111 or AF145 LVDT's)
Line regulation		< 0.01% output span/Volt
Load regulation		< 0.05% output span (minimum to maximum load)
Output adjustment range		
-null adjustment		± 25%
-gain adjustment		± 10%
Operational temperature	**°C**	0 to + 70
Storage temperature	**°C**	-20 to + 85
Temp. coefficient of output		< 0.01% of span volts/°C
Transducer types		5 wire ratiometric LVDT only
Mechanical housing		Entrelec 11000 series (to suit DIN EN50022/EN50035 rails)
Weight maximum	**g**	100

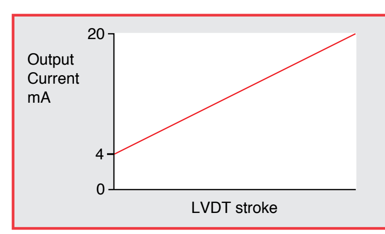
* When powered with a single rail supply, the output may not quite reach 0 Vdc
For this reason, linearity is specified for 1% to 99% of LVDT stroke.

OUTPUT CHARACTERISTICS

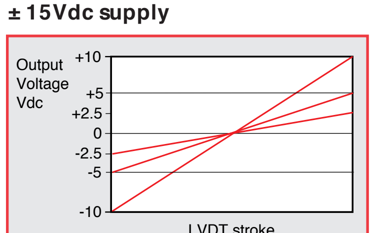
18 - 30Vdc supply



18 - 30Vdc or ± 15Vdc supply



± 15Vdc supply

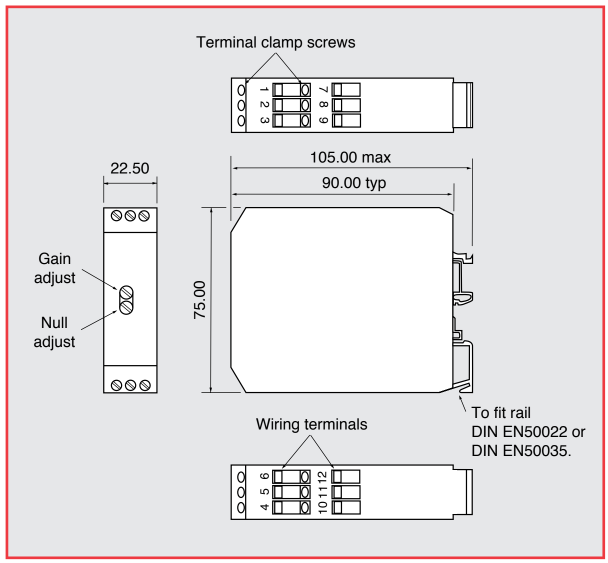


Note: This module is user configurable for input and output options. See set-up guide supplied with module for full instructions.

OUTPUT OPTIONS

Output option	Power supply option 18 - 30Vdc	Power supply option ± 15Vdc
± 2.5Vdc	N/A	✓
± 5Vdc	N/A	✓
± 10Vdc	N/A	✓
0 - 5Vdc	✓	✓
0 - 10Vdc	✓	✓
4 - 20mA (SCM100/I only)	✓	✓
Slope reversal	✓	✓

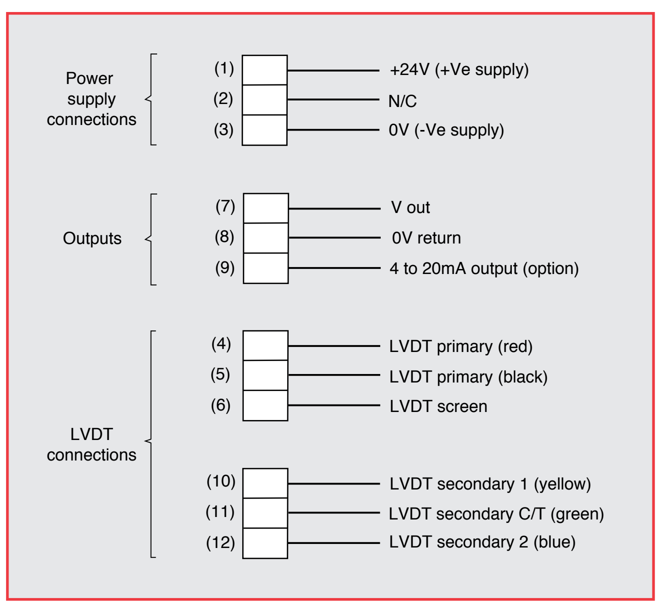
DIMENSIONS



ELECTRICAL CONNECTIONS

Screw terminals

Note:
Refer to the SCM100 set-up guide for details on how to connect to a ± 15Vdc (split rail) power supply.
Misconnection of the supply may cause permanent damage.



AVAILABILITY

Normally available from stock

ORDERING CODES

SCM100/.....

V = Voltage output
I = Current output

LVDT DISPLACEMENT TRANSDUCERS

OPERATION AND USE

What is an LVDT?

LVDT is the acronym for Linear Variable Differential Transformer. The LVDT is a non-contacting linear displacement transducer which works on a principle of mutual inductance, producing an electrical signal which is proportional to a separate moving core (or armature). The fundamental advantages of LVDT transducers are their high degree of robustness, infinite resolution and ability to operate at high temperatures and in extreme environments.

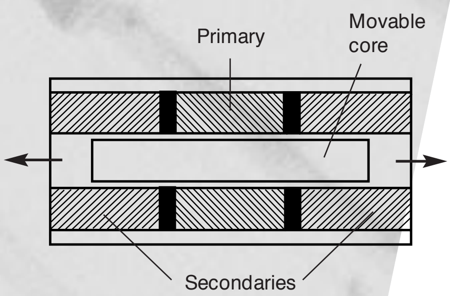


Fig A) LVDT cross sectional diagram

LVDT principle

The LVDT consists of a primary winding, two secondary windings and a separate, movable high permeability core (Fig A). When the primary winding is driven with an a.c. voltage a corresponding a.c. voltage is induced in the two secondary windings, in proportion to the position of the movable core. The secondary windings are connected in series opposition to form the transformer secondary (Fig B).

When the core is centered with respect to the two secondary windings, they will have the same magnitude of induced output voltages, but the polarity (or phasing) will be opposite.

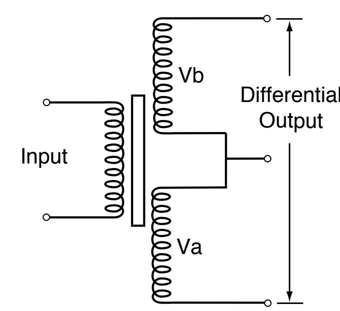


Fig B) LVDT differential output connection

When the core is displaced from this null position, the output amplitude on one secondary coil (Va) increases, while the output amplitude in the other coil (Vb) decreases (Fig C). These voltages can be used individually or combined to produce an output signal proportional to position, dependant upon the method of demodulation used. The two main methods used are described below.

Individual output voltage schematic

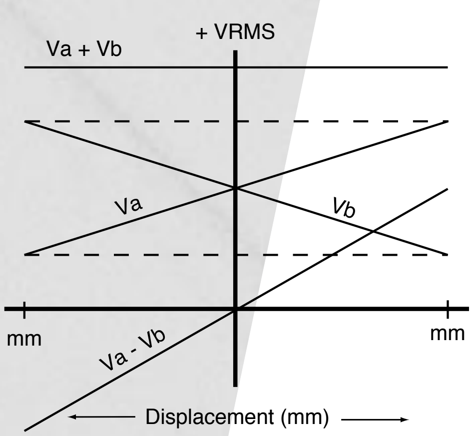


Fig C)

Ratiometric operation

A high accuracy method of translating the LVDT output is to measure the secondary voltages independently to generate a ratio of the difference divided by the sum of these values.

$$\text{Ratio} = \frac{Va - Vb}{Va + Vb} \qquad \text{(Fig. D)}$$

This configuration is commonly referred to as ratiometric operation and will provide much higher system accuracy performance than operation in the differential mode.

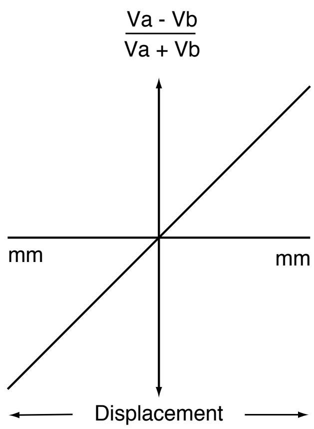


Fig D)

Ratiometric operation provides:

- Improved immunity to LVDT supply voltage and frequency variations
- Improved immunity to errors due to temperature effects on LVDT sensitivity
- Improved frequency and phase response
- Improved immunity to common-mode noise on LVDT lines
- Improved transducer interchangeability

Additionally, the sum of the secondary output voltages (Va + Vb) is nominally constant throughout the LVDT stroke range, so it can be used for system error detection in high integrity systems.

To operate in the ratiometric mode requires a five or six wire, centre-tapped LVDT specifically designed for the purpose, as with Penny+ Giles AF145 and AF111 LVDT's.

Penny+ Giles recommend the use of the SCM100 LVDT driver or DML300 LVDT Driver/ Panel Indicator, which are specifically designed to operate in this mode.

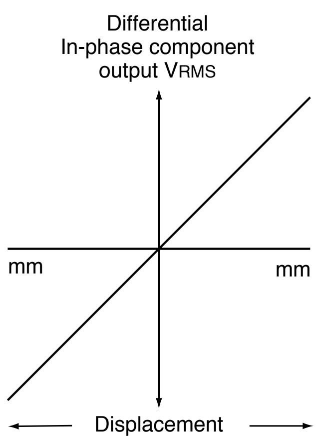


Fig E)

Differential operation

LVDT's are normally available with either four or five wires, where the extra wire is the centre-tap in the output. When operating in the differential mode, this centre-tap connection is often not used.

The output is taken across the whole transformer secondary, (see Fig. B). In this connection configuration, when the core is displaced from the centre null position, the output will increase in-phase with the input in one direction and anti-phase with the input in the other.

To derive the position from the LVDT, a modulator is required to provide the primary ac voltage in conjunction with a demodulator to translate the in-phase component transformer secondary output (Fig. E) to a dc signal proportional to position.

When using LVDT's in this differential mode the output will be directly affected by changes in supply voltage, operating temperature and supply frequency; and is therefore of lower accuracy.

Comparisons

LVDT's operating in the differential mode will typically provide a temperature coefficient of sensitivity of up to 500ppm/°C.

LVDT's which have been designed to operate in the ratiometric mode use specialist winding techniques which achieve figures almost an order magnitude better - typically as low as 12ppm/°C. This is comparable with linear potentiometers (20 to 40ppm/°C).

An additional major benefit of this special ratiometric winding technique is the reduced body-to-stroke length ratio for devices over 25mm stroke. Typically values of between 30 and 40% reduction in LVDT body length can be achieved using this technique.